

B3 Movement into and out of Cells

B3.1 Diffusion

Definition: the net movement of particles from a region of higher concentration to a region of lower concentration (down a concentration gradient), as a result of their random movement.

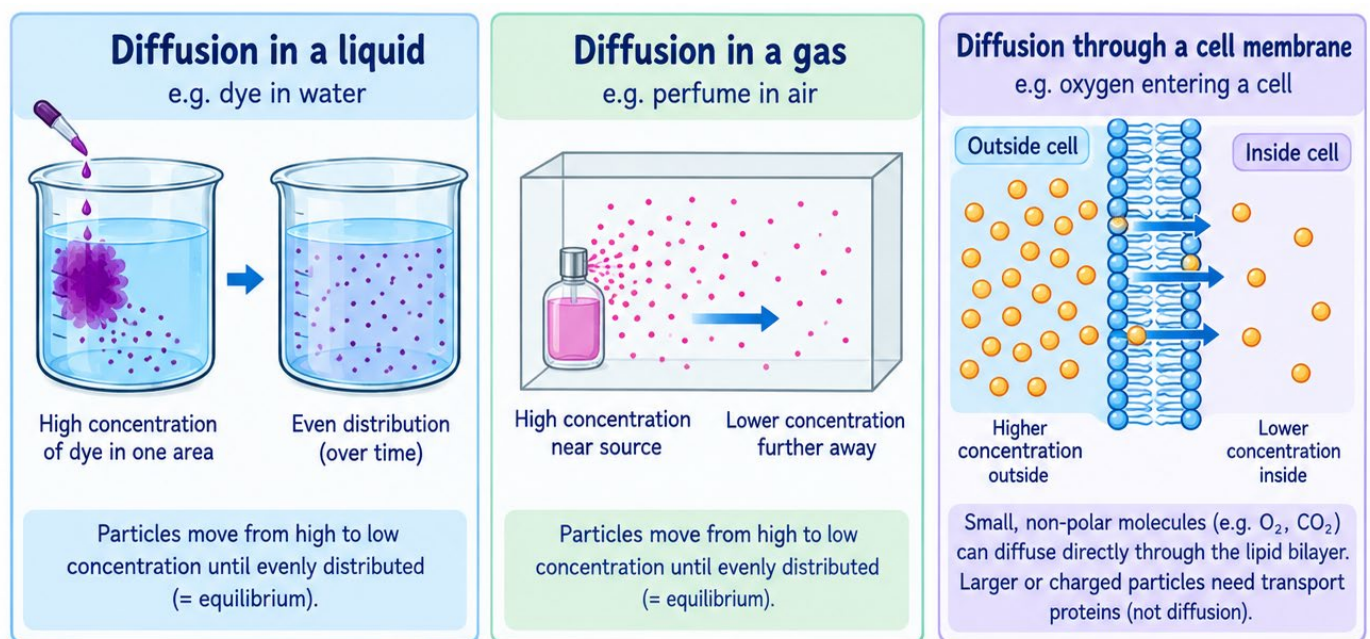
- Passive: needs no energy
- Some substances enter / leave cells by diffusion through the cell membrane

Importance:

- Gases:
 - O_2 into cells for respiration; CO_2 out.
 - In plants, CO_2 in for photosynthesis; O_2 out.
- Solutes: e.g. digested food (glucose) from the gut into the blood

Factors affecting the rate of diffusion:

- Surface area: larger = faster
- Temperature: higher = faster
(particles have more kinetic energy)
- Concentration gradient: steeper = faster
- Distance: shorter = faster



B3.2 Osmosis

Definition: the **net movement of water molecules** from a region of **higher water potential** (dilute solution) to a region of **lower water potential** (concentrated solution) through a **partially permeable membrane**.

Water enters and leaves cells by osmosis through the cell membrane.

Osmosis is a special case of diffusion, involving water only.

Effects on plant cells:

- In dilute solution/pure water: water enters, the cell becomes turgid. Turgor pressure (pressure of the contents against the cell wall) keeps the plant firm.
- In concentrated solution: water leaves, the cell becomes flaccid. If severe, the membrane pulls away from the cell wall: plasmolysis.

Investigation:

Immerse plant tissue (e.g. potato cylinders) in different concentrations

- Gain in mass/length = water entered
- Loss in mass/length = water left
- No change = same concentration inside and out

 **Gain in mass/length**
= water entered

- Cell takes in water
- Becomes turgid (swells)



(larger / heavier)

 **No change**
= same concentration
inside and out

- No net movement of water
- Remains the same size



(same size / mass)

 **Loss in mass/length**
= water left

- Cell loses water
- Becomes flaccid (shrinks)



(smaller / lighter)

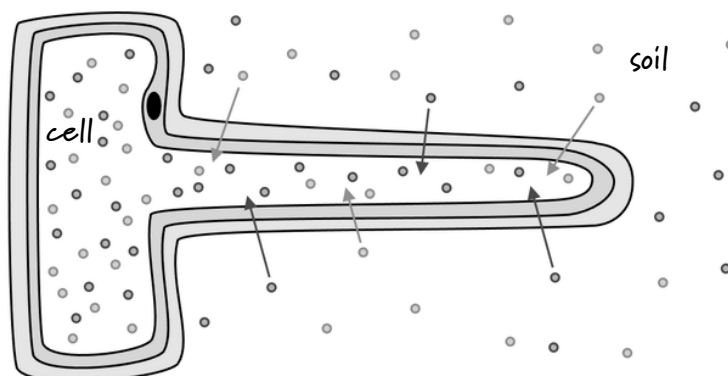
Turgid = swollen and firm; flaccid = limp; plasmolysis = membrane pulled from the wall.

3.3 Active Transport

Definition: the movement of particles through a cell membrane from a region of **lower concentration** to a region of **higher concentration (against the concentration gradient)**, using **energy from respiration**

Importance: moves molecules or ions across membranes when diffusion can't

- e.g. **ion uptake by root hair cells** (mineral ions are more concentrated in the cell than the soil)



SUMMARY

Process	Direction	Energy needed?	Key words
Diffusion	High → low concentration	No	Net movement, random, concentration gradient
Osmosis	High → low water potential	No	Water only, partially permeable membrane
Active transport	Low → high concentration	Yes (respiration)	Against gradient, e.g. root hairs